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SELECTION, INSTALLATION, AND CARE OF LINOLEUM

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I. INTRODUCTION

This letter circular has been prepared in response to numerous requests from the public for information relative to linoleum. There is at present much confusion in the retail market as to the meaning of the term "linoleum". It is applied indiscriminately by retailers and consumers alike to printed enamel felt-base floor covering and synthetic surface floor covering as well as to linoleum. This situation should not be ascribed to any intention on the part of manufacturers or distributors to mislead consumers, but rather to the lack of knowledge on the part of retail sales people and consumers as to what the term "linoleum" means .

Each of the above types of floor covering may be identified by the composition and thickness of the wear layer. The wear layer of linoleum consists of oxidized linseed oil, fossil, or other resins and/or rosin, or an equivalent thoroughly oxidized oleoresinous binder, intimately mixed with wood flour, ground cork and pigments. The wear layer of synthetic surface floor covering consists of cellulose nitrate, or resin and drying oil, or resin-treated cellulose fibers. The wear layer of printed enamel floor covering consists of an oleoresinous enamel. The latter is readily distinguished from felt-backed linoleum because the thickness of the wear layer is usually 0.004 to 0.007 inch, whereas the nominal thickness of the wear layer of felt-backed linoleum is approximately 0.030 inch, 0.050 inch, and 0.085 inch for light, standard, and heavy gauge, respectively.

Linoleums may be divided into two groups, namely: fabric-backed and felt-backed. The fabric backing may be either cotton or burlap; the felt backing may be either asphalt- or resin-treated. Linoleum is furnished in a variety of styles, which may be identified as follows.

II. DEFINITIONS

Battleship linoleum (1)[a] - Linoleum floor covering of a single color, specifically including ground cork as one of the ingredients, on a fabric backing. The color extends from the surface to the backing material.

Plain linoleum (2) - Linoleum floor covering of a single color. The color extends from the surface to the backing material.

Jaspe linoleum (2) - Linoleum generally of two colors combined to produce a striated effect, the striations of which are in the long direction of the roll rather than across the width of the roll.

Marbleized linoleum (2) - Linoleum of two or more colors combined to produce a variegated surface simulating marble.

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[a]Numbers in parentheses refer to publications listed at the end of this circular.

Straight-line inlaid linoleum (3) - An inlaid linoleum, the pattern of which is formed by pieces cut from sheets of linoleum mix of various colors, fitted together on the backing to form the desired pattern, then pressed to form a single sheet. When the material is bent until the wearing surface breaks through to the backing, the breaking line between the inlaid portions through to the backing should be straight and well defined; that is, there should be no bleeding of one portion into another.

Molded inlaid linoleum (3) - An inlaid linoleum, the pattern of which is formed by sifting linoleum mix through stencils on to the backing and then pressed to form a single sheet. When the material is bent until the wearing surface breaks through to the backing, the breaking line between the inlaid portions should be well defined; that is, there should be no bleeding of one portion into another. This type of linoleum may be embossed, a process which presses certain portions of the pattern (generally between different colors) below the surface, and effectively raises in relief the remaining portions of the pattern.

Thickness designation - Table 1 defines the relationship of thickness of linoleum with linoleum manufacturers' gauges for both fabric- and felt-backed goods.

Table 1 - Relationship of thickness and manufacturers' gauges.

Style	Backing	Manufacturers' gauge	Nominal overall thickness inch	Nominal thickness of available wearing surface inch
Battleship	Fabric	3/16 inch	0.187	-
"	"	1/8 inch	0.125	-
Plain and inlaid	"	1/8 inch	0.125	-
"	"	Standard	0.079	-
"	Felt	Heavy	0.125	0.085
"	"	Standard	0.090	0.050
"	"	Light	0.070	0.030

III. SELECTION

Linoleum may be selected for use on subfloors above grade or below grade if not in direct contact with the ground. For the latter, adequate ventilation must be provided between the ground and the subfloor to prevent accumulation of moisture. If the subfloor is on-grade or below-grade in direct contact with the ground, flooring manufacturers' recommendations for other types of smooth-surface floor coverings to be used in these locations should be consulted. Basement floors are usually on-grade or below grade in direct contact with the ground.

The color of linoleum to be selected is usually a matter of satisfying a particular decorative scheme or personal preference. Plain colors are apt to show dirt and soiling more conspicuously than jaspe, marbleized or inlaid patterns. This is also true of very light or very dark colors as compared with medium shades.

Fabric-backed linoleum is intended for the more severe service conditions. All battleship and some plain, inlaid and jaspe linoleums are furnished with this type of backing. These linoleums are especially suitable for commercial or semi-commercial installations. Felt-backed linoleums are suitable for the usual domestic installations where furniture loads and indentations of the floor covering, resulting from these loads, are not severe.

The thickness of linoleum selected by the purchaser should be dependent upon severity of traffic, intended permanency of the installation, and frequency of redecoration of the space in which the material is to be used. Standard gauge is recommended for average conditions of use in domestic installations, while light gauge will generally be sufficient where the material is not exposed to much traffic. Battleship linoleums are considered preferable for heavy-duty commercial and institutional requirements where a decorative pattern on the floor is not essential and especially if good maintenance can not be given. Where a decorative pattern on the floor is desired for such service, 1/8-inch (fabric-backed) jaspe, marbleized, or inlaid linoleum may be used. Heavy gauge (felt-backed) linoleum is suitable for less severe commercial use and for the kitchen or other rooms in the home where traffic may be extremely heavy, and long uninterrupted service is wanted. The purchaser may wish to install in a summer camp or rented dwelling a lighter gauge of linoleum than would be recommended for the same location in a permanent home.

Some manufacturers furnish special types of felt backing on linoleum. One type is intended for use over wood floors without the use of a lining felt. Another type is designed to facilitate taking up the linoleum for removal or replacement.

IV. INSTALLATION

1. GENERAL

For a satisfactory job of installing linoleum, great care is required. It is not a task which can be indiscriminately undertaken by an amateur, and should be given the same consideration as any other job in the skilled mechanical trades. It must be remembered at all times that linoleum is not intended for use on any subfloors in direct contact with the ground, or on wood floors which are over an unexcavated area unless adequate ventilation is provided in the space beneath the floor. When subject to dampness from beneath, moisture will cause a loosening of the bond to the floor and will most likely result in an unsatisfactory installation.

The general procedure for laying linoleum is to properly prepare the subfloor to form a dry, even, rigid surface, cement thereon a lining felt, and then cement the linoleum to the lining felt. The lining felt provides a more quiet floor and will compensate for dimensional changes in the subfloor which result from changes in relative humidity and temperature during different seasons of the year. When selecting the felt, it is well to remember that dry lining felt is easier to remove than saturated lining felt, but the latter is more durable under severe traffic conditions, especially trucking (4). Linoleum and lining felt may be cemented in place with either linoleum paste or linoleum cement. Linoleum paste (lignin paste) is partially soluble in water and can be readily removed after dampening moderately. The linoleum cements are not readily soluble in water, and the removal of linoleum and lining felt, cemented with this type of adhesive, is difficult and time consuming. Linoleum cements are generally considered desirable for installations on stair-treads, metal subfloors, and sink tops or other locations where linoleum may be subject to spilling or flooding of water from above. Subfloors are of various types, and specific information for their preparation before laying linoleum thereon follows:

2. PREPARATION OF SUBFLOOR

a. WOOD SUBFLOOR, DOUBLE LAYER

Broken or badly damaged boards must be replaced and loose boards renailed to secure a rigid surface. It is essential that the boards show no springiness. Protruding butts and joints of all boards should be sanded or planed to form an even surface. Cracks, one-eighth inch or more in width, and holes, one-quarter inch or more in diameter, should be filled. Badly worn or low spots in the subfloor should be leveled with a floor-filling mix. Proprietary products intended for trowel application are available, but if these can not be conveniently obtained, a suitable material may be prepared as follows:

1-1/2 parts by volume asphalt emulsion.
1 part by volume Portland cement.
3 parts by volume clean, sharp sand.
Sufficient clean water to be added as required to produce troweling consistency.

When using this material, it is advisable to prime the area to be covered, using a primer coat consisting of equal parts of asphalt emulsion and water. The primer should be dry or tacky before the floor filling mix is applied. A smooth surface can be obtained on the material by steel troweling the mix after initial set but before final set has occurred. Within 24 hours after application, the material will generally attain sufficient hardness to bear foot traffic. When using proprietary products, application should be made in accordance with the directions of the manufacturer of the product.

All old paint, varnish, wax, and oil should be removed from the floor by sanding or scrubbing with hot trisodium phosphate solution (2 to 3 pounds of the salt dissolved in one gallon of water). This solution should not be allowed to come in contact with the skin or clothing. Rubber gloves should be worn. All solution should be removed by thorough rinsing and the floor allowed to dry. Sanded floors should be sized with a water-resistant coating, such as shellac.

b. WOOD SUBFLOOR, SINGLE LAYER

The laying of linoleum over a single wood subfloor is not recommended. If the subfloor is made of tongued-and-grooved boards, it should be covered with a second layer of plywood of 1/4-inch thickness or greater, or an equivalent material. Plywood should be cut into pieces not over four feet square, then laid with staggered joints to minimize long joints insofar as possible, and be secured to the subfloor at six-inch intervals

in both directions, with screw or barbed nails. All nails should be driven flush with the top surface of the plywood. When adequately nailed, there should be no springiness at any area. Springiness may eventually cause the nails to work loose and push upwards through the linoleum. All joints should be filled with plastic wood or equivalent material and sanded to form a smooth surface.

If the subfloor does not consist of tongued-and-grooved boards, a layer of tongued-and-grooved boards (not over 3-1/2 inches in width) should be placed thereon at an angle of 45 degrees to the underlayer, securely toe-nailed and face-nailed to form a rigid surface, and then sanded to form a smooth surface. The sanded floor should be sized with a water-resistant coating, such as shellac. Plywood of 5/8 or 3/4 inch thickness or equivalent material, installed as described above for single wood floors, may be used in lieu of the layer of tongued-and-grooved boards.

c. CONCRETE SUBFLOOR

Old concrete floors should have any chalky or scaly paint removed by scrubbing with hot trisodium phosphate solution (2 to 3 pounds of the salt dissolved in one gallon of water.) This solution should not be allowed to come in contact with the skin or clothing. Rubber gloves should be worn. The floor should then be thoroughly rinsed with water, and allowed to dry. It is essential that the concrete be thoroughly dry before linoleum is installed. Excessive dampness in concrete floors can be detected as follows: On the concrete at each corner of the room and also at the center, form a ring of putty about six inches in diameter and one-half inch high. In each ring place a small ash tray or coaster containing about a level teaspoonful of anhydrous calcium chloride and cover each ring with a piece of glass, pressing the glass down on the putty to prevent air leakage. If the floor is damp, beads of moisture will appear on the ash tray or coaster within 24 hours. The test can be made more positive by drilling holes in the surface of the concrete at the location to be circumscribed by the ring of putty. All badly worn or low spots in the concrete floor should be leveled with a floor filling mix as described in the paragraph "Wood subfloor, double layer". Expansion score marks or cracks may be filled with a mixture of Portland cement and plaster of Paris gauged with water to a stiff troweling consistency.

3. LAYING LINOLEUM ON WOOD FLOORS

After the subfloor has been prepared as described above, shoe mouldings should be removed from the base boards, the floor swept clean, and lining felt rolled out on the floor. The direction of the felt should be at right angles to the direction of the top boards. The felt should be cut and fitted along the walls allowing a small clearance between the baseboard and the edge of the felt. The edges of adjacent pieces of felt should be abutted, not overlapped, and cross joints staggered. One-half of each piece of felt should be rolled back and the exposed area of the floor covered with linoleum paste or linoleum cement using a notched trowel. The notches in the trowel should be 1/16 inch deep, 1/16 inch wide and spaced 1/8 inch apart. The type of adhesive should be selected on the basis of information given in the paragraph "General" above. The adhesive may be spread ahead of the laying about 90 square feet as long as "skin" is not allowed to form. Replace the felt over the adhesive and roll or "walk-out" any apparent air bubbles, working from the center toward the edges. Roll back the remaining half of each piece of felt and repeat the above operations.

Linoleum should be kept at a temperature of at least 70°F for at least 48 hours before being unrolled, and all work should be done at the same temperature or higher. Linoleum should be laid by a procedure similar to that described for the felt, with the seams in the linoleum at right angles to the direction of the top boards of the floor. Linoleum should be cut neatly and accurately to fit the room with the least possible number of seams. The pattern should be matched carefully at all seams. Seams in the linoleum should not come directly over seams in the lining felt. If there should be any irregularities of the edges of the linoleum, neat joints can be made by lapping the best edge on top of the adjoining strip a scant fraction of an inch and cutting the under strip, using the edge of the top strip as a guide. After all air bubbles are worked out from under the linoleum, the seams and edges may be tapped lightly with a smooth-faced hammer, then weighted until the adhesive sets. Any linoleum paste on the surface of the linoleum can be removed with a wet sponge. Linoleum cement can be removed by using a cloth dampened with kerosene. Exposed edges at doorways should be protected with suitable metal or other molding to prevent scuffing and loosening of the edge. Shoe mouldings should be reinstalled along the baseboard to cover the edges of the

linoleum. Some felt-base linoleum is furnished with a special backing designed to permit installation on wood floors without the use of lining felt. If this type of linoleum has been obtained, the lining felt is not required, and the linoleum should be laid on the floor at right angles to the direction of the top boards. In other respects the linoleum should be installed as described above.

4. LAYING LINOLEUM ON CONCRETE FLOORS

The test for dampness in concrete floors should be made, and the laying of linoleum should proceed only when the test indicates dampness is not present. After the subfloor has been prepared as described above, shoe moldings should be removed from the baseboards and the floor swept clean. The use of lining felt is optional on concrete subfloors. The linoleum should be laid in the direction to produce the least number of seams. In other respects the linoleum should be laid as described for wood floors, above.

5. OTHER INFORMATION

Manufacturers of linoleum should be consulted for additional information and recommendations for installation of linoleum on types of subfloors in addition to those described herein. They are also glad to furnish to architects and contractors specifications for installation of linoleum and items of work related thereto.

V. CARE

All heavy pieces of furniture and chairs should have small domes or glides removed from the bases or legs. Glass, rubber, metal, synthetic resin, or similar material molded in the form of shoes to fit the bases should be installed in their places. These will provide a greater bearing area to support the weight of the furniture and therefore are less likely to mar the surface of the linoleum. For light chairs, it is good practice to remove any small domes or glides and slightly round the sharp edges of the front legs. The rear edges and corners of the rear legs should be well rounded.

Mild household soaps or automobile soaps that are free from alkali are suitable for use on linoleum. Scouring powders that contain abrasive or alkali are not satisfactory for

cleaning linoleum. The surface should be rinsed with clean water to remove all the soap, then dried. The floor should not be flooded with water because this procedure may affect the cementing material and loosen the bond of the linoleum to the floor. The clean, dry linoleum should be waxed, allowed to dry before walked upon, and polished by rubbing with a weighted floor brush or an electric polishing machine. Paste or liquid floor wax can be used, but water-emulsion wax is easier to apply. Polishing water-emulsion wax, although not absolutely necessary, is beneficial. The floor should be swept daily, or more often if necessary, with a soft brush or a dry dust mop, and polished lightly to restore the luster. Washing and rewaxing should be repeated when necessary. Waxing not only enhances the appearance of the floor but also adds to the life of the linoleum. Floors that are kept well waxed and swept clean should not require frequent washing. Sweeping compounds containing oil should not be used on linoleum as the materials may leave a film of oil on the surface to collect dust and dirt (5).

VI. REFERENCES

1. Federal Specification LLL-L-351a; Linoleum, battleship. 5 cents

2. Federal Specification LLL-L-367; Linoleum, plain, jaspe, and marbleized. 5 cents

3. Federal Specification LLL-L-359; Linoleum, inlaid and molded. 5 cents

4. Performance test of floor coverings for use in low-cost housing: Part 3. P.A. Sigler and E.A. Koerner, NBS Report BMS68. 15 cents

5. The Care of Floors. NBS Letter Circular LC-764.

The above Government publications are available from the Government Printing Office, Superintendent of Documents, Washington 25, D. C. The prices quoted are for delivery to addresses in the United States and its territories and possessions, and in certain foreign countries which extend the franking privilege. In the case of all other countries, one-third the cost of the publication should be added to cover postage. Remittance should be made either by coupons

(obtainable from the Superintendent of Documents in sets of 20 for $1.00 and good until used), or by check or money order payable to the "Superintendent of Documents, Government Printing Office" and sent to him with order. The publication not priced may be obtained directly from the National Bureau of Standards.

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